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NOTES ON SOME CRAYFISHES FROM ALABAMA CAVES, WITH THE DESCRIPTION OF A NEW SPECIES AND A NEW SUBSPECIES

By Rendell Rhoades

From Dr. Alvin R. Cahn, formerly chief of the Biological Readjustment Division of the Tennessee Valley Authority, I received a small collection of crayfishes that he had collected in Shelta Cavern and Belgreen Cave, in northern Alabama. Those from Shelta Cavern had been tentatively determined as *Cambarus pellucidus*, but in order to establish their status definitely it was necessary to secure more material. Early the next year I obtained a male, form I, from this same cavern and later additional material from Leslie Hubricht, of the Missouri Botanical Garden. With his aid I have been enabled to study a complete series of this particular crayfish, which is here described as a new subspecies of *Cambarus pellucidus* Tellkampf (1844). The crayfishes from Belgreen Cave are described as a new species of *Cambarus*. This particular species is interesting because it shows affinities to both cave and surface forms.

The types and allotypes of the new forms have been deposited in the United States National Museum; paratypes are in the Alabama Museum of Natural History, the Academy of Natural Sciences of Philadelphia, the collection of Leslie Hubricht, and my own collection.

I am indebted to Dr. Cahn and Mr. Hubricht for the bulk of the material reported on in this paper. Grateful acknowledgment is also made to Dr. Walter B. Jones, director of the Alabama Depart-

ment of Conservation and director of the Alabama Museum of Natural History, who has generously provided me with material from several caves in that State. Dr. Allan F. Archer, director of research, Alabama Department of Conservation, has assisted both in collecting the material and the data. I wish to express my thanks to Dr. A. H. Wiebe, chief of the Biological Readjustment Division, Forestry Relations Department, Tennessee Valley Authority, who has been most cooperative during the course of this study.

Genus CAMBARUS Erichson (1846)

Subgenus FAXONIUS Ortmann (1905)

CAMBARUS (FAXONIUS) PELLUCIDUS AUSTRALIS, new subspecies

Male I.—Body white, digestive tract dark. Rostrum with margins only slightly converging. Marginal spines short and acute. Acumen long and slender. Upper surface of rostrum moderately concave. Postorbital ridges with short acute spines. Sides of carapace minutely granular. Cervical groove unbroken in front of five or six lateral spines on each side. Spininess usually reduced from typical *C. pellucidus*. Antennae as long as the body. Antennal scale broadest anterior to the middle, with inner margin gently rounded. Apical spine short; half the length of that of typical *C. pellucidus*. Dorsal surface of chelipeds with small tubercles. Tips of fingers sparingly setose. Hooks on the third walking legs prominent, globose, and recurved. Hooks on the fourth walking legs lacking. Gonopods reaching to the coxopodites of the third walking legs. Rami short and nearly equal in length. Outer ramus, with corneus tip, curved tightly around the inner ramus. Inner ramus straight with slightly recurved slender fleshy tip. Setose along the ventral line.

Male II.—Hooks on the third walking legs recurved and rounded but reduced in size. Gonopods with fleshy tips reaching to the coxopodites of the third walking legs. Inner ramus a little more inflated.

Female.—Annulus ventralis contrasting sharply with that of typical *C. pellucidus* in that the large central hemispherical tubercle has its greatest height on the anterior wall. The tubercle recedes posteriorly and levels out to form a narrow flat border for the full width of the annulus. A shallow median furrow marks the posterior slope and becomes deeper and sinuate with a sharp curve to the observer's right in the posterior margin.

Variations.—I have placed in this subspecies a crayfish from several caves in northern Alabama on the basis of identical genitalia. However, there are slight variations from cave to cave. The num-

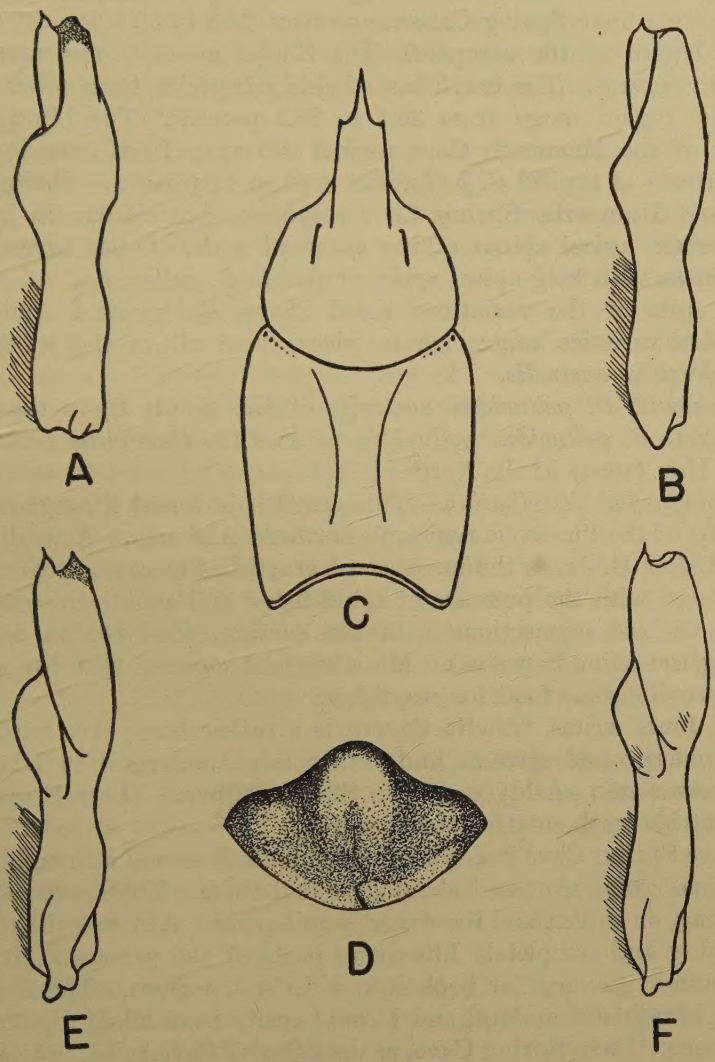

FIGURE 35.—*Cambarus pellucidus australis*, new subspecies: *A*, Gonopod, male, form I, outer view; *E*, gonopod, male, form I, inner view; *C*, dorsal view of carapace; *D*, annulus ventralis; *B*, gonopod, male, form II, outer view; *F*, gonopod, male, form II, inner view.

ber of lateral spines of the carapace varies from two to nine. The spines are not necessarily paired. A specimen may have four spines on the left side and nine on the right side. The areolae of the specimens from Cave Spring Cave range from 33.3 to 36.6 percent of the total length of the carapace. The Shelta material measures 38.5 to 40.5 percent. The crayfishes of this subspecies from other caves in this region range from 36.1 to 39.5 percent. The blind crayfishes of the Mammoth Cave region also vary from cave to cave. The areola of typical *C. pellucidus* is 36 to 41 percent. Shelta Cavern and Huntsville Spring Cave specimens are similar in having very short apical spines of the antennal scale. Other caves yield specimens with long apical spine similar to *C. pellucidus*.

In spite of the variations listed above, the marked similarity of these varieties causes me to place them all in the subspecies *C. pellucidus australis*.

No doubt *C. pellucidus australis* of the South bears the same affinity to *C. pellucidus pellucidus* as does the *Cambarus pellucidus testii* Hay (1893) of the North.

Ecology and distribution.—This crayfish is found throughout the caverns of the limestone region in northern Alabama. According to Dr. Walter B. Jones the presence of crayfishes in caves seems to be correlated with the presence of blind fishes and aquatic insects. In caves without connections with the surface, food chains develop among the animals present. Mr. Hubricht suggests that bat guano may provide some food for crayfishes.

Dr. Jones writes, "Shelta Cavern is a rather large cave with several underground streams and rather large underground lakes. I have never seen muddy waters in Shelta Cavern. There is scarcely any outside trash entering the passages.

"Cave Spring Cave is a typical underground stream although there are some rooms scattered about here and there. That cave is 3,050 feet long, or longer, and the water is quite cold. At times the stream is muddy and completely fills many parts of the passage. In fact, one cannot go very far back into it in wet seasons. The crayfish fauna is rather abundant, and I could easily have taken a gallon of specimens. Cave Spring Cave, as does Shelta Cavern, has white fish.

"Huntsville Spring Cave is about ¾ mile long with a low ceiling and a deep-channeled stream. It is reached by a vertical manhole in a street near the center of the city. The roof and the floor are irregular. The stream is spring-fed and permanent, having an average flow of 39,000,000 gallons a day. The cave is located under the city of Huntsville and is full of narrow passages, crevices, and loose rock. No fish have been found there.

"Saddler Springs Cave is a typical underground stream that has no connection with the surface. Apparently there has never been the slightest bit of sediment or trash in the cave. Stalactites are like crystal, and the floor of the stream is neatly carved out of limestone rock with scarcely any sand or gravel anywhere in the place. The crayfish fauna is somewhat limited, as are the other faunas.

"McFarlen Cave is some 700 feet long and of varying width. The entrance is archlike and of easy access. The stream is located in back of the cave, and is spring-fed. It is my impression that there is no permanent water in the front portion of the cave. The water level may have been higher in former times. Boulders are to be found on the floor of the cave. No fish have been taken there.

"Saltpeter Cave, in the Clear Creek area of Jackson County, is located under a high bluff near the foot of a mountain. It is of the fissure type. It is 1,895 feet long and most of its length is in the zone of total darkness. The floor of the cave has a stream, evidently permanent, and fed by several springs."

Type locality.—Shelta Cavern, SE¼NE¼ sec. 27, T. 3 S., R. 1 W., north of Huntsville, Madison County, Ala.

Material examined.—Two males II, 1937, Alvin R. Cahn coll. (one paratype, U.S.N.M. No. 79365); 1 male I, March 1, 1938, Alvin R. Cahn coll. (holotype, U.S.N.M. No. 79363); 1 male II, 2 females, August 5, 1939, Leslie Hubricht coll. (one female is the allotype, U.S.N.M. No. 79364); 3 males II, 3 females, 5 young, September 28, 1940, Walter B. Jones coll.

Additional records.—Cave Spring Cave, NW¼NE¼ sec. 10, T. 5 S., R. 2 E., near New Hope, Madison County, Ala., September 26, 1939, Walter B. Jones (1 male II, 3 females, 5 young); December 1, 1939, Walter B. Jones (4 males II, 6 females).

Huntsville Spring Cave, SE¼SW¼ sec. 36, T. 3 S., R. 1 W., Huntsville, Madison County, Ala., October 6, 1939, Walter B. Jones (1 female).

Saddler Springs Cave, SE¼NE¼ sec. 3, T. 4, R. 1 E., Monte Sano State Park, Madison County, Ala. June 14, 1940, Walter B. Jones (1 male I, 4 males II, 3 females).

McFarlen Cave, SW¼NW¼ sec. 22, T. 3, R. 3 E., near Garth, Jackson County, Ala., February 29, 1940, Walter B. Jones (2 males I, 1 male II, 1 female).

Saltpeter Cave, NW¼SW¼ sec. 16, T. 3, R. 3 E., Jackson County, Ala., June 9, 1940, Walter B. Jones (1 male I, 6 males II, 4 females).

Subgenus CAMBARUS Erichson (1846)

CAMBARUS (CAMBARUS) CAHNI, new species

Male I.—Unknown.

Male II.—Body white, digestive tract dark. Rostrum of moderate length, sides converging and sharply elevated. Marginal spines small and often reduced to angles. Acumen rather short and broad. Broad median carina reaching to a line drawn between the postorbital spines. Carapace slender, rounded, and minutely granular on the sides. Cervical groove sinuate but unbroken, on the sides above small rounded tubercles. Lines of the areola not clearly defined. Length of areola varying from 36.7 to 40.5 percent of the length of the carapace. Width accommodating three rows of widely spaced dots. Epistoma oval, with small acute terminal spine. Lateral margins sharply elevated. Antennae reaching to the telson or beyond. Antennal scale triangular, broadest anterior to the middle. Apical spine short. Chelae rather smooth, two or three rows of low tubercles on the inner margin of the palm. Dots distributed evenly over the hand but tending to form furrows on the dorsal surface of the fingers, two on the immovable finger and three on the movable finger. Fingers two to three times the length of the inner margin of the palm and twice as long as the width of the palm. Merus with prominent furrow in the dorsal surface. Sharp spine on inner surface with 0 to 3 small accessory spines. Carpus with usual biserial row of spines down the ventral. Outer series much exceeded by the inner. Hooks on the third walking legs rather sharp and recurved. Gonopods thick, with fleshy tips recurved at right angles with the shank. Inner ramus with tips slightly outcurved as well as recurved. Setae on the ventral line.

Female.—Chelae slightly shorter. Annulus broadly ovate. Central and posterior regions elevated. Anterior wall somewhat depressed. Fossa anterior and shallow. Median furrow curved to form a small blunt hook to the observer's left in a central position.

Affinities.—*C. cahni* is intermediate between the "Section of *C. hamulatus*" and the "Section of *C. extraneus*" (Ortmann, 1931, pp. 95–96). However, the cave modifications place it in the former section. The carapace is subcylindrical, the chelae are long and subcylindrical, and the eyes are greatly reduced, though not to the extent found in *C. hamulatus*. The gonopods are recurved and the lateral spines are present on the rostrum. I believe this crayfish has sufficient constant and peculiar characteristics to give it the status of a distinct species.

I possess a female crayfish from Saddler Springs Cave that is lightly pigmented on the carapace and the dorsum of the abdomen. It bears close resemblance to *C. cahni* in the subcylindrical carapace

and body proportions. However, the eyes are normal, the antennae are shorter, and the antennal scale is much narrower. The sides of the rostrum converge more strongly, and there is no trace of a median carina. The lateral spines of the carapace are small and acute. The annulus ventralis is bisected by a deep median furrow which curves strongly to the observer's left to form a large blunt

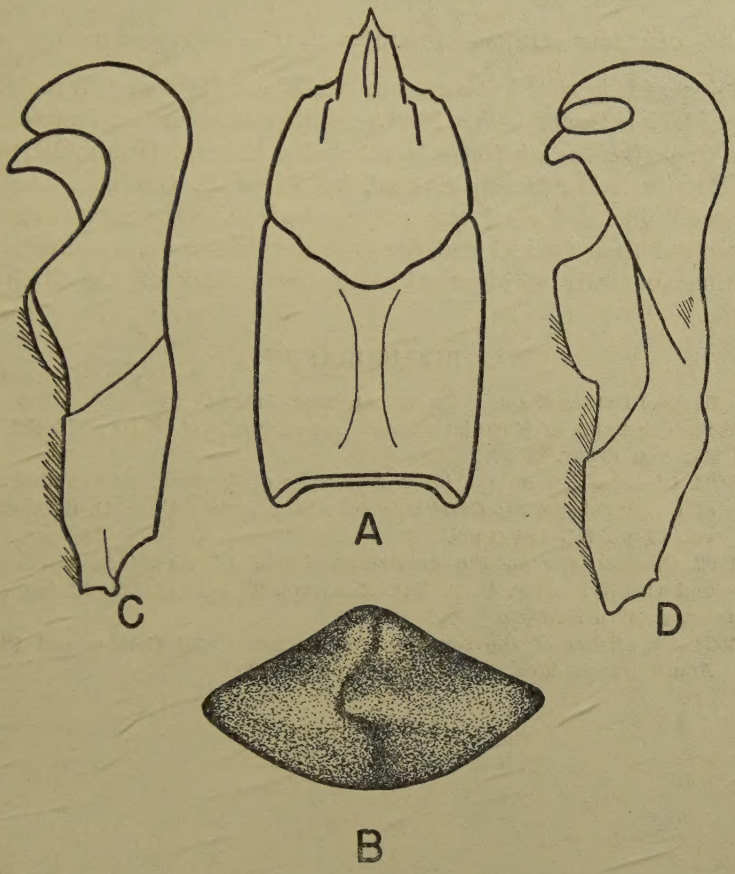

FIGURE 36.—*Cambarus cahni*, new species: *A*, Dorsal view of carapace; *B*, annulus ventralis; *C*, gonopod, male, form II, outer view; *D*, gonopod, male, form II, inner view.

lobe. I do not place this record with *C. cahni* since the specimen at hand bears greater affinity to the "Section of *C. extraneus*" than to the "Section of *C. hamulatus*."

Distribution.—C. cahni is known only from the type locality, but it will probably be found distributed over the limestone cave region of northern Alabama where cave ecology is suitable. Belgreen Cave is a small cave with a very deep underground stream. The stream becomes muddy and almost fills the cavern in wet seasons.

Type locality.—Belgreen Cave, NW¼SW¼ sec. 12, T. 7 S., R. 13 W., Franklin County, Ala.

Material examined.—Five males II; 4 females, May 24, 1937, Alvin R. Cahn coll. (one male is the holotype, U.S.N.M. No. 80031; 1 female is the allotype, U.S.N.M. No. 80032.)

I take pleasure in naming the species for my friend Dr. Alvin Robert Cahn, its collector.

CAMBARUS (CAMBARUS) HAMULATUS (Cope and Packard (1881))

The species is well known from Nickajack Cave and Wine House Cave, Marion County, Tenn. An additional record, a female taken with *C. pellucidus australis* from Shelta Cavern, Huntsville, Madison County, Ala., March 1, 1938, by Alvin R. Cahn, is here contributed. The sides of the rostrum of this specimen are more convergent than typical and the lateral spines are very short. The annulus ventralis is identical with the annuli of the Nickajack female.

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